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school. Reading of this sort is greatly needed in all branches of science, and nowhere more than in meteorology. Look, for example, at the account given of the effects of melting ice and freezing water on the temperature of the adjacent air. The effects appear either in time alone, or in both time and place. When lakes freeze, they retard the early winter fall of temperature, and when they melt they retard the spring warming by an equal amount: this effect is constant in place, but varies in time. On the other hand, when snow falls, the liberation of energy in its freezing affects the temperature of the air at some distance above the earth's surface, making it warmer than it would have been if condensation had not taken place; but the same snow, melting afterwards on the ground, keeps the air there from warming as much or as soon as it would had the snow been absent. Here, then, is an effect that varies in place as well as in time. It is like carrying ice from New England to India: if this once famous industry had been extensive enough, it would have raised our mean temperature, and lowered that of the torrid zone where the ice melted.

The second volume of the work is given to a general geographic account of climate. Here a comparison naturally arises with Hann's 'Klimatologie,' that appeared a few years ago. The subjects treated are identical; the difference is only in the plan of treatment and in degree of emphasis given to one part or another by the two authors. Dr. Hann made free use of original accounts by travellers and foreign observers, and inserted abstracts of their writings in smaller type, after presenting his own general statements; he also included the various climatic tables in the text, alongside of the paragraphs that they illustrate. Dr. Woeikof reduces the records that he consults to common form, and postpones all tables to the end of the book, where they appear with numerous diagrams that have small representation in Dr. Hann's book. Preference between two methods such as these is probably a matter of taste, my own being for that followed by the Austrian author; but the other will doubtless find equal approval. The absence of sufficient reference to earlier authors makes both books less useful than they might have been; but the insertion of the references would have materially increased the size of the volumes, already large, and I believe it was for this reason that they were omitted.

The duplication caused by the almost simultaneous appearance of these two books on one subject can only be regarded as a great advantage. They were independently prepared by leading specialists; and the careful reader, who wishes to think as well as to quote, will gain a solid, stereoscopic comprehension of the subject by approaching it from these two slightly different points of view.

Foods and Food Adulterants. Part I. Dairy Products. (U. S. Dept. Agric., Bull. No. 13.) Washington, Government. 8°.

THIS bulletin, which has been prepared by H. W. Wiley, chemist, is devoted chiefly to a discussion of the best methods of detecting the adulteration of dairy-products, that of butter being treated with greater detail than any other. During the past year the division of chemistry has been supplied with apparatus for photo-micrography, and most of the illustrations, twenty-four in number, are the work of the division. Great benefit has been derived from this method of fixing the photographic appearance of the crystalline character of butter and butter substitutes. The illustrations show the crystalline appearances of butter, beef-fat, lard, butterine, and oleomargarine, and are well executed. The bulletin contains the text of the act of 1886, passed by Congress, defining butter, and imposing a tax upon, and regulating the manufacture, sale, importation, and exportation of, oleomargarine; also a detailed history of artificial butter from its first manufacture by Mége-Mouriéz, in 1870, to the present time. The writer of the bulletin believes, that, while a great deal of artificial butter has been thrown upon the market, that has been carelessly made, and therefore harmful to the health, still a butter substitute, made carefully out of the fat of a perfectly healthy bullock or swine, is not prejudicial to health. This opinion is supported by quotations from the leading authorities, such as Professors Morton, Chandler, Barker, and others. The best methods of butter and milk analysis are described in detail, both microscopical and chemical. Other bulletins are being prepared, and will soon be issued, treating of condiments, sugar, sirup and honey, drinks and canned goods, flour and meal, tea and coffee, and baking-powders.

Milton's Paradise Lost. Books I. and II. Ed. with introduction and notes, by M. MACMILLAN. New York, Macmillan. 16°.

THE difficulties of Milton's works are so great, owing to the Latinized structure of his style and his many learned allusions, that they require a commentary almost as much as the ancient classics do. Nor have our scholars neglected to provide such helps; yet for school purposes most of them leave much to be desired. The little book before us is one of the best works of the kind that we have seen, and will help to make the reading of Milton both easier and pleasanter. It is confined to the first two books of 'Paradise Lost,' which the editor rightly considers the grandest portion of Milton's works. The notes are accurate and very exhaustive, as may be seen from the fact that they fill eighty-four pages of the volume, while the text fills only fifty-four. Almost every thing is explained in them that a student would need to have explained, and the explanations are simple and clear. An introduction of moderate length gives an account of the conception and composition of 'Paradise Lost,' together with some judicious criticisms on the poem. The book may be heartily commended for educational use.

Schiller's Wilhelm Tell. With Introduction and Notes by G. E. FASNACHT. London, Macmillan. 24°.

Schiller's Wallenstein. Part I. Das Lager. With Introduction and Notes by H. B. COTTERILL. London, Macmillan. 24°.

MESSRS. MACMILLAN & CO. have, in the two books named above, made valuable additions to their Foreign School Classics series. The Wallenstein is preceded by a well-written historical sketch of the origin and character of the thirty-years' war. The difficulties in reading Wilhelm Tell do not lie in Schiller's style and diction. These are throughout transparently clear. Not so the subject-matter. The reader's progress is delayed at almost every step by historical allusions, provincialisms, topographical and meteorological terms, for the elucidation of which even the advanced student needs to have a complete cyclopædia at his elbow. All this reference-hunting involves a great waste of time, and this little edition of the work has been edited with the view to placing these side-lights at the disposal of the reader.

Higher Algebra. By H. S. HALL and S. R. KNIGHT. London, Macmillan. 16°.

THE present work is a sequel to the author's 'Elementary Algebra for Schools.' The first few chapters are devoted to a fuller discussion of ratio, proportion, variation, and the progressions, which in the former work were treated in an elementary manner. The discussion of convergency and divergency of series always presents great difficulty to the student. To render this the more intelligible, the authors have introduced a short chapter on limiting values and vanishing fractions. In the chapter on summation of series they have laid much stress on the method of differences and its wide and important applications. Permutations and combinations and the theory of probability have received due attention, also the theory of determinants and their applications. The last chapter contains all the most useful propositions in the theory of equations suitable for a first reading.

Naturae Veritas. By GEORGE M. MINCHIN. London, Macmillan. 16°.

WE learn from the author's preface that in this poem he has related certain things, which, in a temporary absence from this earth, he received from a being who, having completed the change of existence, had attained to a knowledge of the universe far transcending the capacity of man. The poem is descriptive of the author's supposed stellar visits in quest of information, which should lay at rest his doubts in regard to the dissipation of energy. Unfortunately the journey was without result.

The Owens College Course of Practical Organic Chemistry. By J. B. COHEN. London, Macmillan. 16°.

THIS little book on organic chemistry will be received with favor, doubtless, and has already received the high indorsement of Prof. Henry E. Roscoe and Prof. C. Schorlemmer. Any course of practical organic chemistry leading up to original work must mainly consist in a careful preparation of a well-selected series of organic compounds. Dr. Julius Cohen has in this little book collected such

a series; and doubtless the book, which is a novel one, will prove useful alike to professors, assistants, and students. Its primary purpose is that of a laboratory guide.

Four Figure Mathematical Tables. By J. T. BOTTOMLEY. London, Macmillan. 12°.

THIS is a series of mathematical tables comprising logarithmic and trigonometrical tables, and tables of squares, square roots, and reciprocals. In an appendix are contained a number of useful formulas and numbers, especially for those engaged in work in physical laboratories. The book is compiled by a lecturer in natural philosophy in the University of Glasgow.

NOTES AND NEWS.

IN order to expedite the publication of short articles upon astronomical and meteorological subjects which may be prepared at Harvard College Observatory, it has been decided to print them as successive numbers of a series, which will constitute the eighteenth volume of the 'Annals of the Observatory' when a sufficient amount of material has thus been collected. Each number will be published and distributed soon after it has been prepared.

— During this month will appear, under the editorship of Dr. G. H. Rohé, a quarterly journal, *The Climatologist*, devoted to the consideration of questions in the domain of medical and sanitary climatology. As there is at present no other journal in the world exclusively occupying this special field, the editor and publishers believe that there is room for such a publication. Each number will contain forty-eight quarto pages of reading-matter, the subscription price will be fifty cents per year, and the place of publication, S. E. Cor. Baltimore and South Streets, Baltimore, Md.

— Dr. John Vansant of the United States Marine Hospital at St. Louis claims to be the first to have taken photographs by the light of fireflies. He placed twelve fireflies in a three-ounce bottle, covering its mouth with fine white bobinet. The average duration of the flash of each insect was half a second, and the luminous area on the abdomen was about one-eighth of an inch square. The time of exposure was fifty flashes.

— Lieut. J. F. Moser, U.S.N., commanding the Coast Survey steamer 'Bache,' has just submitted a report of the hydrographic work executed by that steamer from Cedar Keys southward to a point off Chasahowitzka River, and the finishing of the hydrography from Cape Romano to the delta of the Mississippi. He refers to the great difficulty of running triangulations, owing mainly to the obscurity or entire absence of former triangulations, or other ear-marks of the locality to be surveyed. St. Martin's Reef was found to continue as far north as Homosassa, thence trending eastward to join the shallow waters of Crystal River. It is on the Florida banks, of which St. Martin's Reef forms an inshore part, that many of the commercial sponges are taken, and a large number of vessels are yearly engaged on the work. The tides in this locality were found to be easily affected by winds, causing great irregularity in their range, stand, and times of movement. The coast was found to be low and rocky, and the entire bottom covered with porous rock. The anchorage off St. Martin's Reef is good and safe in any weather except a hurricane. Lieutenant Moser says the country is dreary, desolate, and uninhabited, and the coast-line consists of fringing islands, thickly covered with mangrove. On these islands oysters are found growing in trees, the spawn having attached themselves to the branches at high water and developed into oysters. Bird-life was not abundant, even sea-gulls being conspicuous by their absence. Rail and blue and white herons were found, but even these birds have been driven away by the plume-hunters.

— A. Auwers has thoroughly discussed the alleged periodical changes of the diameter of the sun, and finds that in fact they do not exist. His researches, which are founded on 19 series of observations, — 12 of which refer to the horizontal diameter, and comprise 21,000 observations, while 7 refer to the vertical diameter, — show that the periodical changes are due to the influence of the temperature upon the instruments with which the observations were made, and that for this reason the period corresponds to that of the annual period of temperature.

LETTERS TO THE EDITOR.

Experimental Physics for Schools.

FOR years one of the requirements for admission to Harvard College has been such knowledge of physics as may be obtained from the study of any one of certain well-known elementary textbooks. To this requirement is now added the study of a certain astronomical text-book, but as an alternative to both the text-book physics and the astronomy there is recommended a course of study in physics involving considerable laboratory work on the part of the pupil, supplemented by instructions from a text-book or a course of lectures.

Two questions suggest themselves to the teacher of physics when he finds himself met by the proposition to give laboratory practice to a whole class: 1st. Is this desirable if practicable? 2d. Is it practicable?

Without undertaking to discuss at large the theory of a liberal education, we can note a few considerations which will enable us to answer the first of these questions with some confidence: 1st. Physics is studied partly for training and partly for information. 2d. Text-book physics alone gives but little training that cannot be given by arithmetic, algebra, and geometry, all of which studies are pursued by the pupil before he enters college. 3d. Physics as taught by the laboratory experience of the pupil gives a kind of training that is not given by any course of study *required* for admission to Harvard College or, perhaps, any other college in the country. This training is partly of the senses and partly mental. It is true that many book-studies educate the senses to a certain extent, and the logical faculties, but unfortunately it is possible for a person who is observing and logical in things which he is in the habit of studying to be quite the opposite in dealing with things which do not habitually occupy his mind. Now, laboratory physics is the only elementary study for admission to Harvard College that requires the student to look beyond the pages of a book, and although most students do look at other things than books, they are not in the habit of *studying* things outside of books. 4th. The information given by the text-book alone is wide but superficial and vague. It is like that knowledge of a country which one may get by travelling rapidly over it on a railroad train. 5th. The information given by laboratory practice alone is definite but narrow. It is like that knowledge of a country which one would get if he tried to go over the whole of it on foot. 6th. Most students show far more interest in laboratory work than in the study of a text-book, even when the same subjects are dealt with in both cases. Much of the repugnance which many students feel for physics as they study it comes from the almost painful effort of the imagination to body forth the things described in the text-books, and which might be seen directly and handled in the laboratory.

From these considerations we reach the conclusion that the course which Harvard recommends to preparatory schools is desirable, if practicable, viz., to have the pupil study intimately certain topics by the laboratory method, and to enlarge upon, apply, and connect the knowledge so gained, by means of a text-book or a course of lectures. In the opinion of the writer, a course of lectures sufficiently extensive and systematic to take the place of a text-book for this purpose is beyond the present powers of most preparatory schools.

It may be hoped that by following such a course in physics the student will escape, on the one hand, a condition of blind and helpless dependence upon text-books, and, upon the other hand, the scarcely less unfortunate state of self-sufficiency which cannot or will not profit by the literature of the science.

Harvard University has issued for the use of teachers engaged in preparing students for its college classes a pamphlet giving a list of forty laboratory exercises, with specifications of the apparatus and materials to be used in these exercises, and with directions for their performance, or references to manuals giving such directions. These exercises are to be performed by the pupil. To speak cursorily, they deal with certain distinctive characteristics of the solid, liquid, and gaseous states of matter, the determination of specific gravities, the first principles of statics and dynamics, evaporation and boiling, the determination of the fixed points of a thermometer, expansion of solids and gases, specific heat, latent heat, velocity of sound, interference of